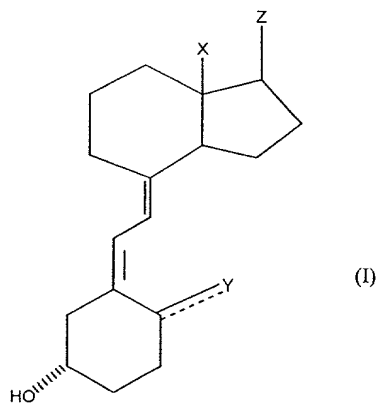


CLAIM(S)

What is claimed is:

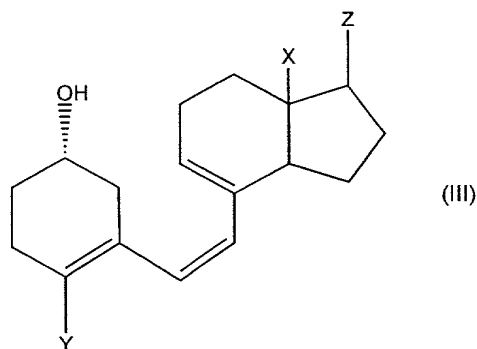
1. A method of achieving an effect in a patient comprising administering an effective amount of a vitamin D compound which is a 24-hydroxyvitamin D or a 24-hydroxyprevitamin D wherein the effect is treating or preventing bone loss or bone mineral content, hyperparathyroidism, hyperproliferation, or modulating the immune and inflammatory responses.

2. The method of claim 1, wherein said 24-hydroxyvitamin D is a compound of formula (I):



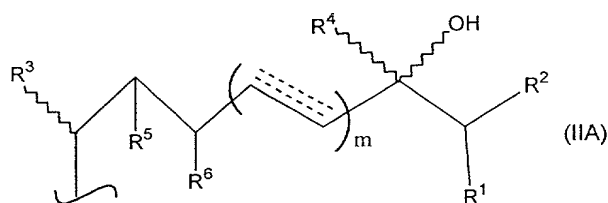
wherein Z represents a saturated or unsaturated, substituted or unsubstituted, straight-chain or branched C<sub>4</sub> - C<sub>18</sub> hydrocarbon group in which the C-24 or equivalent position is hydroxylated; Y is a methylene group if Y is double bonded to the A-ring or a methyl group or hydrogen if Y is single bonded; and X is hydrogen, lower alkyl or lower fluoroalkyl.

3. The method of claim 1, wherein said 24-hydroxyprevitamin D is a compound of formula (III):



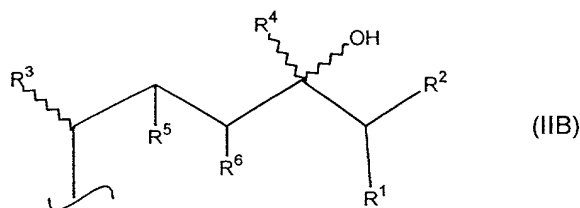
wherein Z represents a saturated or unsaturated, substituted or unsubstituted, straight-chain or branched C<sub>4</sub> - C<sub>18</sub> hydrocarbon group in which the C-24 or equivalent position is hydroxylated; Y is a methyl group or hydrogen; and X is hydrogen, lower alkyl or lower fluoroalkyl.

4. The method of claim 1 wherein Z is a side chain of formula (IIA):



wherein a dotted line along the side chain represents an optional additional C-C bond and m is 0 or 1; R<sup>1</sup> and R<sup>2</sup> are independently lower alkyl, lower fluoroalkyl, lower alkenyl, lower fluoroalkenyl, lower cycloalkyl or, taken together with the carbon to which they are bonded, form a C<sub>3</sub>-C<sub>8</sub> cyclohydrocarbon ring; R<sup>3</sup> is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; R<sup>4</sup> is lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; and R<sup>5</sup> and R<sup>6</sup> are each hydrogen or taken together form a double bond between C-22 and C-23.

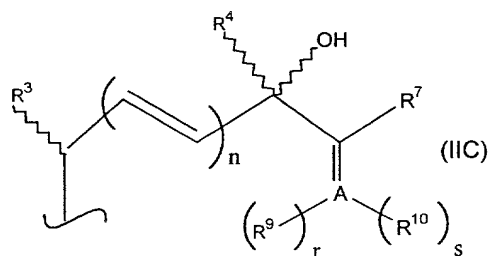
5. The method of claim 1 wherein Z is a side chain of formula (IIB):



wherein  $R^5$  and  $R^6$  are each hydrogen or taken together form a double bond between C-22 and C-23,  $R^3$  is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl;  $R^4$  is lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; and  $R^1$  and  $R^2$  are independently hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl, lower fluoroalkenyl, lower cycloalkyl or taken together with the carbon to which they are bonded form a  $C_3$ - $C_8$  cyclocarbon ring.

6. The method of claim 5, wherein said 24-hydroxyvitamin D is 24-hydroxyvitamin  $D_2$ ; 24(S)-hydroxyvitamin  $D_2$ ; 24-hydroxyvitamin  $D_4$ ; 24(R)-hydroxyvitamin  $D_4$ .

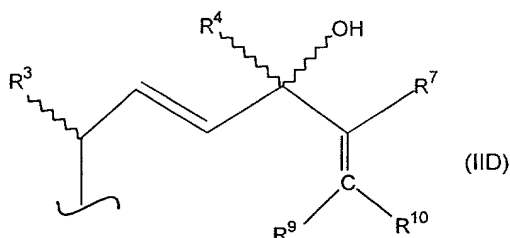
7. The method of claim 1 wherein Z is a side chain of formula (IIC):



wherein  $n$  is an integer which is 1 or 2;  $R^3$  is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl;  $R^4$  and  $R^7$  are independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; A is carbon, oxygen, sulfur or nitrogen;  $r$  is 1 and  $s$  is zero when A is nitrogen;  $r$  and  $s$  are 1 when A is carbon;  $r$  and  $s$  are zero when A is sulfur or oxygen; and when A is carbon,  $R^9$  and  $R^{10}$  are

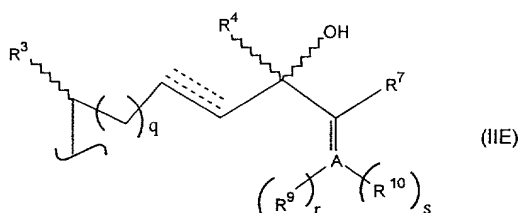
independently hydrogen, lower alkyl, lower alkenyl, lower fluoroalkyl or lower fluoroalkenyl.

8. The method of claim 1 wherein Z is a side chain of formula (IID):



5 wherein  $R^3$ ,  $R^9$  and  $R^{10}$  are independently hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; and  $R^4$  and  $R^7$  are independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl.

10 9. The method of claim 1 wherein Z is a side chain of formula (IIE):



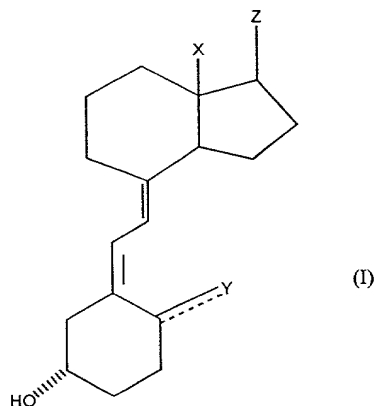
15 wherein a dotted line along the side chain represents an optional additional C-C bond; q is zero or an integer which is 1 or 2;  $R^3$  is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl;  $R^4$  and  $R^7$  are independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; A is carbon, oxygen, sulfur or nitrogen; r is 1 and s is zero when A is nitrogen; r and s are 1 when A is carbon; r and s are zero when A is sulfur or oxygen;  $R^9$  and  $R^{10}$  are

independently hydrogen, lower alkyl, lower alkenyl, lower fluoroalkyl or lower fluoroalkenyl.

10. The method of claim 9 wherein said 24-hydroxyvitamin D compound is 24-OH-25-ene-D<sub>2</sub>; and 24-OH-25-oxo-D<sub>2</sub>.

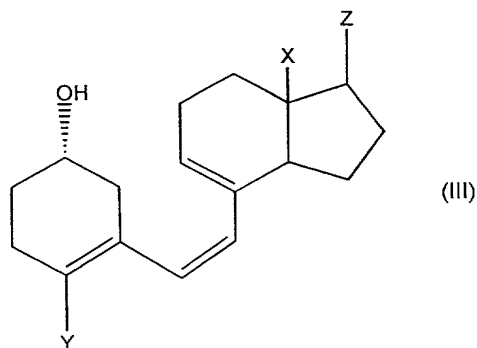
5 11. A method of achieving an effect in a patient comprising administering an effective amount of a vitamin D compound which is a 24-hydroxyvitamin D or a 24-hydroxyprevitamin D wherein the effect is increasing or maintaining bone mass or bone mineral content, lowering or maintaining lowered parathyroid hormone level, inhibiting  
10 hyperproliferative effects, inducing or enhancing cell differentiation modulating immune response, and modulating inflammatory response.

12. The method of claim 11, wherein said 24-hydroxyvitamin D compound is a compound of formula (I):



15 wherein Z represents a saturated or unsaturated, substituted or unsubstituted, straight-chain or branched C<sub>4</sub> - C<sub>18</sub> hydrocarbon group in which the C-24 or equivalent position is hydroxylated; Y is a methylene group if Y is double bonded to the A-ring or a methyl group or hydrogen if Y is single bonded and X is hydrogen, lower alkyl or lower fluoroalkyl.

13. The method of claim 11, wherein said 24-hydroxy $\textit{previtamin}$  D is a compound of formula (III):



wherein Z represents a saturated or unsaturated, substituted or unsubstituted, straight-chain or branched  $C_4 - C_{18}$  hydrocarbon group in which the C-24 or equivalent position is hydroxylated; Y is a methyl group or hydrogen; and X is hydrogen, lower alkyl or lower fluoroalkyl.

14. A method of treating a human to alleviate the pathological effects of osteoporosis, hyperparathyroidism, psoriasis, skin cancer, breast cancer, colon cancer, prostate cancer, prostatic hyperplasia and immune response imbalance and inflammatory response in balance, wherein the method comprises administering to the human a vitamin D compound which is a 24-hydroxyvitamin D or a 24-hydroxy $\textit{previtamin}$  D wherein said compound is administered to the human in an amount sufficient to increase or maintain bone mass or bone mineral content, lower or maintain lowered parathyroid hormone level, inhibit hyperproliferative effects, induce or enhance cell differentiation, modulate immune response and modulate inflammatory response in the human.

15. A pharmaceutical composition comprising an effective amount of a substantially pure, synthesized a 24-hydroxyvitamin D or a

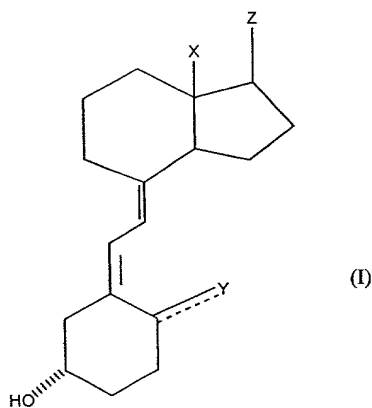
24-hydroxyvitamin D and a pharmaceutically acceptable carrier, adjuvant or vehicle.

16. The composition of claim 15, wherein the composition is orally administrable.

5 17. The method of claim 1 wherein said 24-hydroxyvitamin D compound is administered in a dosage of about 3.5  $\mu\text{g}$  to about 1000  $\mu\text{g}$ /week.

10 18. The composition of claim 15 wherein the composition is further combined with a bone agent, a cytotoxic agent, an immune response regulating agent, an antiinflammatory agent or combinations thereof.

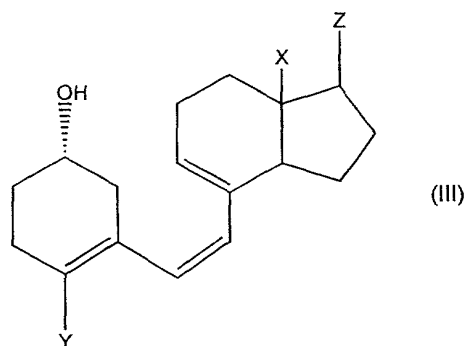
19. A 24-hydroxyvitamin D compound which is a compound of formula (I):



15 wherein Z represents a saturated or unsaturated, substituted or unsubstituted, straight-chain or branched  $\text{C}_4 - \text{C}_{18}$  hydrocarbon group in which the C-24 or equivalent position is hydroxylated; Y is a methylene group if Y is double bonded to the A-ring or a methyl group or hydrogen

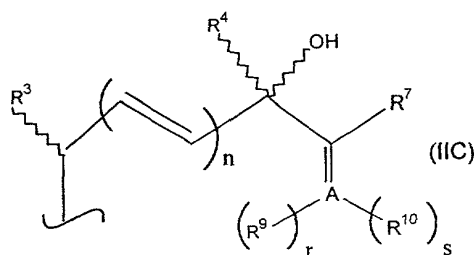
if Y is single bonded provided that the compound of formula (I) is not 24-hydroxyvitamin D<sub>2</sub>; and X is hydrogen, lower alkyl or lower fluoroalkyl provided that the compound of formula (I) is not 24-hydroxyvitamin D<sub>2</sub>.

20. A 24-hydroxyprevitamin D which is a compound of formula (III):



wherein Z represents a saturated or unsaturated, substituted or unsubstituted, straight-chain or branched C<sub>4</sub>-C<sub>18</sub> hydrocarbon group in which the C-24 or equivalent position is hydroxylated; Y is a methyl group or hydrogen; and X is hydrogen, lower alkyl or lower fluoroalkyl.

21. The compound of claim 19 wherein Z is a side chain of formula (IIC):

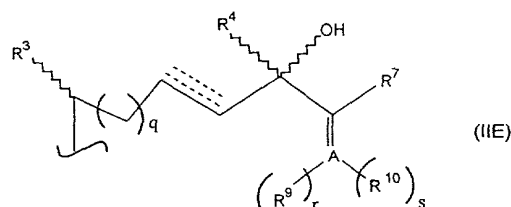


wherein n is an integer which is 1 or 2; R<sup>3</sup> is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; R<sup>4</sup> and R<sup>7</sup> are independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; A is carbon, oxygen, sulfur or nitrogen; r is 1 and s is zero



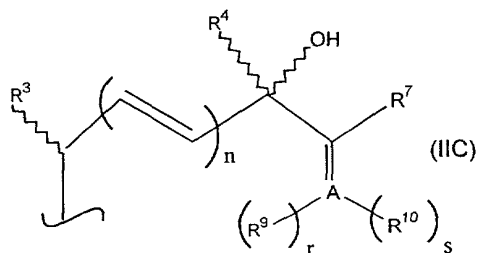
when A is nitrogen; r and s are 1 when A is carbon; r and s are zero when A is sulfur or oxygen; and R<sup>9</sup> and R<sup>10</sup> are independently hydrogen, lower alkyl, lower alkenyl, lower fluoroalkyl or lower fluoroalkenyl.

22. The compound of claim 19 wherein Z is a side chain of formula (IIE):



wherein a dotted line along the side chain represents an optional additional C-C bond; q is zero or an integer which is 1 or 2; R<sup>3</sup> is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; R<sup>4</sup> and R<sup>7</sup> are independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; A is carbon, oxygen, sulfur or nitrogen; r is 1 and s is zero when A is nitrogen; r and s are 1 when A is carbon; r and s are zero when A is sulfur or oxygen; and R<sup>9</sup> and R<sup>10</sup> are independently hydrogen, lower alkyl, lower alkenyl, lower fluoroalkyl or lower fluoroalkenyl.

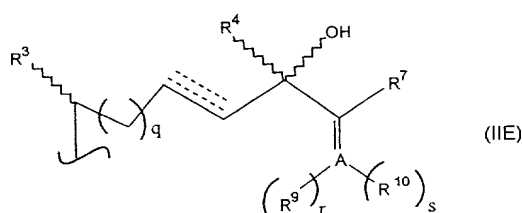
23. The compound of claim 20, wherein Z is a side chain of formula (IIC):



wherein n is an integer which is 1 or 2; R<sup>3</sup> is hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; R<sup>4</sup> and R<sup>7</sup> are

independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; A is carbon, oxygen, sulfur or nitrogen; r is 1 and s is zero when A is nitrogen; r and s are 1 when A is carbon; r and s are zero when A is sulfur or oxygen; R<sup>9</sup> and R<sup>10</sup> are independently hydrogen,  
 5 lower alkyl, lower alkenyl, lower fluoroalkyl or lower fluoroalkenyl.

24. The compound of claim 20, wherein Z is a side chain of formula (IIE):



wherein a dotted line along the side chain represents an optional additional C-C bond; q is zero or an integer which is 1 or 2; R<sup>3</sup> is  
 10 hydrogen, lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; R<sup>4</sup> and R<sup>7</sup> are independently lower alkyl, lower fluoroalkyl, lower alkenyl or lower fluoroalkenyl; A is carbon, oxygen, sulfur or nitrogen; r is 1 and s is zero when A is nitrogen; r and s are 1 when A is carbon; r and s are zero when A is sulfur or oxygen; and R<sup>9</sup> and R<sup>10</sup> are  
 15 independently hydrogen, lower alkyl, lower alkenyl, lower fluoroalkyl or lower fluoroalkenyl.

25. As an article of manufacture, a tablet having a relatively high absorption rate for vitamin D as measured by blood level of vitamin D over time after ingestion, comprising a vitamin D compound which is  
 20 24-hydroxyvitamin D or 24-hydroxyprevitamin D and a pharmaceutically acceptable carrier, adjuvant or vehicle.

26. The method of claim 1 wherein said compound is administered in combination with a bone agent, a cytotoxic agent, an immune response regulating agent, an antiinflammatory agent or combinations thereof.

5        27. The method of claim 26 wherein said bone agent is other vitamin D compounds, conjugated estrogens, sodium fluorides, biphosphonates, cobalamin, calcium receptor agonists, pertussin toxin, boron or DHEA.

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